Summary of Possible Cleanup Goals

Pesticide Shop (Area of Concern 3)
Bainbridge Naval Training Center
Port Deposit, Maryland

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Background

The U.S. Fish and Wildlife Service, Chesapeake Bay Field Office (CBFO) is assisting the U.S. Navy in the evaluation of remediation options for the former Pesticide Shop (Area of Concern 3) at the Bainbridge Naval Training Center. This is a location where pesticide storage, formulation, and distribution activities took place when the Center was active. Maps of the Area of Concern and sampling locations are provided in the Environmental Baseline Survey (EA 1997). The purpose of this presentation is to facilitate the selection of cleanup goals.

Methods

Chemical data from two rounds of sampling were provided to CBFO and a spreadsheet is attached (Table 1). The first step in the process is to screen the maximum soil concentrations against the EPA Region III Biological Technical Assistance Group (BTAG) screening levels. The division of a concentration (or estimated intake) by a toxicological reference value (or screening level) results in a hazard quotient (HQ; Table 2).

As shown in Table 2, there are exceedances of the screening levels for the following chemicals: 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, alpha-chlordane, "chlordane" (technical chlordane), gamma-chlordane, and heptachlor epoxide. Because these chemicals were found at maximum concentrations that result in hazard quotients considerably greater than one, further evaluation of risk is needed. To simplify the analysis, DDT and metabolites are grouped as total DDT. There are insufficient data to develop separate toxicity reference values (No Observed Adverse Effect Levels (NOAELs) and Lowest Observed Adverse Effect Levels (LOAELs) for the three compounds. In addition, in the environment, DDT can degrade to either DDD or DDE (World Health Organization 1989) so it does not make sense to develop separate cleanup goals. They have similar toxic mechanisms and are usually co-located. Therefore, a cleanup goal for total

1

DDT would be based on the sum of the three compounds.

Representatives of EPA Region III and its Central Regional Laboratory, the Navy and its chemical contract laboratory, and the Chesapeake Bay Field Office participated in a conference call on February 10, 1999 to discuss the handling of the chlordane data. Technical chlordane is a mixture primarily consisting of alpha- and gamma-chlordane, chlordene, heptachlor, cis-nonachlor, and trans-nonachlor. A separate standard is used for quantitation and it is not equal to the sum of the individual analytes. Oxychlordane and heptachlor epoxide are toxicologically significant degradation products (Eisler 1990). At the Pesticide Shop, not all of these chemicals were analyzed individually. For the purposes of the ecological risk assessment, total chlordane will be considered to be the sum of alpha-chlordane, gamma-chlordane, and heptachlor epoxide. These three analytes were detected consistently in the soil samples and have similar toxic mechanisms. Technical chlordane will not be considered as a separate analyte.

The next step is to evaluate the potential threats to ecological receptors. The organochlorine pesticides can accumulate through terrestrial food chains. In this exercise, we evaluate the HQs to a worm-eating bird (both American woodcock and robins are used as representative species) and a carnivorous mammal (the short-tail shrew is used). When constructing such food chains, it is important to use realistic values to estimate daily intake. A key parameter is the concentration in the earthworm which is used as the dietary component. Since we only have soil data, this concentration must be estimated. We evaluated the literature on the relationship between concentrations of these organochlorine compounds in soil and those in earthworms. Literature was obtained from Dr. Nelson Beyer of the U.S. Geological Survey's Patuxent Wildlife Research Center (PWRC). Dr. Beyer is recognized as an expert on the movement of chemicals in soil and their effects and accumulation in earthworms. We also searched the toxicological literature using several computerized data bases.

One of the key papers was that of Beyer and Gish (1980) who reported on a long-term study performed at PWRC. Dieldrin, heptachlor, and DDT were applied on study plots in 1966 and the concentrations in soil and earthworms were measured on 22 dates between 1966 and 1977. The average concentration ratios (ppm dry wt earthworm:ppm dry wt soil) were 5 for DDT and metabolites and 8 for dieldrin. Edwards and Bohlen (1992) reviewed the literature and reported a concentration factor of 4.0 for chlordane.

Other key inputs to the food chain models are the ingestion rate and body weight of the receptor and the size of the affected area in relation to the area used by the receptor (Area Use Factor). We relied on life history profiles developed by the EPA Environmental Response Team (ERT).

To be conservative, risk assessments often use the lowest home range value reported in the literature. At the Pesticide Shop, the habitat is poor in relation to surrounding areas. Part of the area that was sampled is paved and the soil of the area appears to be rocky. Much of the area appears to be sparsely populated by weeds. Several hundred meters away are higher quality habitats consisting which include shrubs and trees. It is possible that the receptors would

preferentially feed in the higher quality habitat. Therefore, when the ERT profiles listed a minimum and maximum home or feeding range, we chose the highest available value.

Risk assessments also frequently use the lowest available body weight and the highest available ingestion rate. For the purposes of this risk assessment, we chose the mean values for both of these parameters when multiple values were available. The assumptions for the food chain models are shown on the attached spreadsheet (Table 3).

The three spreadsheets (Tables 4-6) show estimated hazard quotients based on the maximum and mean soil concentrations. They also show the hazard quotients that would result if soil was cleaned to 1, 2, or 5 ppm concentrations for total DDT and total chlordane. EPA Region III BTAG has frequently recommended a 1 ppm cleanup goal for total PCBs in soil and sediments, based primarily on concerns about food chain impacts. PCBs were found to have an average earthworm:soil concentration ratio of 3 (Beyer and Stafford 1993). As part of the spreadsheets, we have included a calculation of the hazard quotient that would result if 1 ppm total PCBs were a cleanup goal. This can be used as a reference point for evaluating the hazard quotients for total DDT and total chlordane at 1,2, and 5 ppm cleanup goals.

Results

As a reference point, the 1 ppm PCB soil goal yields the following HQ values based on NOAELs:
        shrew: 11.9
        robin: 1.4
        woodcock: 0

A 1 ppm cleanup goal for total DDT and total chlordane yields the following HQ values (based on NOAELs):

        shrew: DDT - 2.0, chlordane - 8.4
        robin: DDT - 17, chlordane - 90
        woodcock: DDT - 0, chlordane - 2

A 2 ppm cleanup goal yields the following HQ values based on NOAELs:

        shrew: DDT - 3.9, chlordane - 17
        robin: DDT - 34 , chlordane - 179
        woodcock: DDT - 1, chlordane - 3

A 5 ppm cleanup goal yields the following HQ values based on NOAELs:

        shrew: DDT - 10, chlordane - 42
        robin: DDT - 85, chlordane - 449

woodcock: DDT - 2, chlordane - 8

Recommendation

These calculations and charts are intended to provide a framework for discussions of cleanup goals at the Pesticide Shop. A meeting of representatives from the Navy, the EPA Remedial Project Manager, and the BTAG should be scheduled.

References

Beyer, W.N. and C.D. Gish. 1980. Persistence in earthworms and potential hazards to birds of soil applied DDT, dieldrin, and heptachlor. J. Appl. Ecology 17:295-307.

Beyer, W.N. and C. Stafford. 1993. Survey and evaluation of contaminants in earthworms and in soils derived from dredged material at confined disposal facilities in the Great Lakes region. Environ. Monit. Assess. 24:151-165.

Edwards, C.A. and P.J. Bohlen. 1992. The effects of toxic chemicals on earthworms. Rev. Environ. Contam. Toxicol. 125:23-99.

Eisler, R. Chlordane hazards to fish, wildlife, and invertebrates: a synoptic review. USFWS Rep. 85(1.21).

EA Engineering, Science, and Technology. 1997. Environmental Baseline Survey Task 2 Analytical Report Naval Training Center - Bainbridge. Sparks, MD.

World Health Organization (WHO). 1989. DDT and its derivatives -- environmental aspects. WHO, Geneva.

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Spreadsheets with Soil Contaminant Data and Risk Calculations

AOC 3

Pesticide Shop

Bainbridge Naval Training Center

Table 1. Pesticide Shop (AOC 3) rounds 1 and 2 of soil data

Soil pesticide data Rounds 1 and 2 Pesticides	Freq. Det.	AOC3 3-SS-1*	organics in ug/kg 3-SS-2*	3-SS-3*	3-SS-4A	3-SS-4B*	3-SS-5	3-SS-6	3-SS-7	3-SS-8	3-SS-9	3-SS-10	3-SS-11	3-SS-12	3-SS-13	3-SS-14	Max Det	Mean inc. 1/2 d.l.	Mean with 0 for non-det
DDD	14/15	2	1100	580	210	7500	920	1400	1700	2800	290	7300	1300	19000	56000	13000	56000	7540	7540
DDE	14/15	2	760	1500	900	3200	1400	1400	1700	1600	350	3900	1200	9200	22000	7500	22000	3774	3774
DDT	14/15	2	5200	2500	940	14000	6000	7000	7900	6400	890	11000	3700	28000	110000	34000	110000	15835	15835
Total DDT	14/15	6	7060	4580	2050	24700	8320	9800	11300	10800	1530	22200	6200	56200	188000	54500	188000	27150	27149
Heptachlor epoxide	8/15	1	390	200	130	470	230	630	600	195	53	650	95	470	4700	950	650	651	192
alpha-Chlordane	10/15	1	240	80	39.5	1400	95	195	1700	195	42	840	220	2300	15000	2400	15000	1650	1615
gamma-Chlordane	10/15	1	230	97	39.5	1600	200	195	2200	195	57	1100	290	3000	17000	2900	17000	1940	1898
Total Chlordane	13/15	3	860	377	209	3470	525	1020	4500	585	152	2590	605	5770	36700	6250	36700**	4241	4202
"CHLORDANE"	8/15	10	3900	2000	395	16000	950	1900	14000	1900	360	6500	950	19000	150000	9500	150000	15158	14117

Only pesticides with at least one detection are included in this table
* ROUND 1 DATA   **Max is 32000 if 1/2 det. lim. results are not included
Detected concentrations in bold
Non-detects are listed as 1/2 det. lim.
"CHLORDANE" refers to technical chlordane and was listed as a separate analyte in the results
Total chlordane is the sum or alpha and gamma chlordanes plus heptachlor epoxide

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Table 2. Pesticide shop (AOC 3) vs. BTAG screening levels

Pesticide Shop (AOC 3) two rounds - data	Soil (ug/kg)					
Contaminant	Soil Maximum Concentration	Number of Detections	Total Number of Samples	Benchmark	Reference Source	Hazard Quotient
Pesticides/PCB						
4,4'-DDD	56000	15	15	100	x - fauna	560
4,4'-DDE	22000	15	15	100	x - fauna	220
4,4'-DDT	110000	15	15	100	x - fauna	1100
total DDT	188000	15	15	100	x - fauna	1880
Aldrin	ND			100	x - fauna	
alpha-BHC	ND			100	x - fauna	
alpha-Chlordane	15000	10	15	100	x - fauna	150
beta-BHC	ND			NB	NB	
delta-BHC	ND			NB	NB	
"Chlordane"	150000	8	15	100	x-fauna	1500
total Chlordane*	32000	13	15	100	x-fauna	320
Dieldrin	ND			100	x - fauna	
Endosulfan I	ND			NB	NB	
Endosulfan II	ND			NB	NB	
Endosulfan Sulfate	ND			NB	NB	
Endrin	ND			100	x - fauna	
Endrin aldehyde	ND			NB	NB	
Endrin Ketone	ND			NB	NB	
gamma-BHC (Lindane)	ND			NB	NB	
gamma-Chlordane	17000	10	15	100	x - fauna	170
Heptachlor	ND			NB	NB	
Heptachlor Epoxide	650	8	15	100	x - fauna	6.5
Methoxychlor	ND			100	x - fauna	
PCB-1016	NA			100	x - flora	
PCB-1221	NA			100	x - flora	
PCB-1232	NA			100	x - flora	
PCB-1242	NA			100	x - flora	
PCB-1248	NA			100	x - flora	
PCB-1254	NA			100	x - flora	
PCB-1260	NA			100	x - flora	
Toxaphene	ND			NB	NB	
NB = No benchmark						
NA = Not Applicable						
x- fauna= Region III BTAG Screening Level for fauna (lowest of flora and fauna)						
x-flora= Region III BTAG Screening Level for flora (lowest of flora and fauna)						
* Max is 36700 if 1/2 det. lim. for hep ep. is included						

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Table 3. Risk assessment assumptions.

Assumptions				
Total chlordane is the sum of alpha and gamma chlordane and heptachlor epoxide				
Total DDT is the sum of 4,4'DDD, 4,4'-DDE, and 4,4'-DDT				
Woodcock				
Home range:45 acre	only value listed			
Food: 100% earthworm				
Ingestion rate: 0.083 kg/day	only value listed			
Soil ingestion rate: 0.0075 kg/da	only value listed			
Body weight: 0.165 kg	only value listed			
Area Use Factor (AUF): 0.69 acres/45 acres = 0.015		site acreage/home range		
Robin				
Home range:0.3-1 acre territory, forage up to 2 acre; 2 acres used in assessment				
Food: 100% earthworm				
Ingestion rate: 0.89-1.52 g/g B	; used mean = 1.205	; rate=0.127 kg/day		
Soil ingestion rate: 10.4% of diet = 0.013 kg				
Body weight: 0.0773 to 0.1338 kg; used mean: 0.1055				
Area Use Factor (AUF): 0.69 acres/2 acres foraging range = 0.345				
Short-tailed shrew				
Home range:0.5-1acres; 1 acre used in assessment				
Food: 100% earthworm				
Ingestion rate: 0.49-0.62 g/g BW; 0.555 used; rate = 0.0165 kg/day				
Soil ingestion rate: 9.4% of diet = 0.0011 kg/day				
Body weight: 0.012 to 0.030 kg used mean = 0.021 kg				
Area Use Factor (AUF): 0.69 acres/1 acre home range = 0.69				
Bioaccumulation factors (BAFs): dry wt ppm earthworms/dry wt ppm soil				
DDT and metabolites: 5 (Beyer and Gish 1980)				
PCBs: 3 (Beyer and Stafford 1993)				
Chlordane: 4 (Edwards and Bohlen 1992 summary of Gish 1970)				

Table 4. Food chain modeling for the short-tail shrew.

Chemical	Maximum Soil Conc. (mg/kg)	BAF	Max Conc in soil inv. (mg/kg)	Food Ingestion Rate (kg/day)	Soil Ingestion Rate (kg/day)	Intake from food and sed. (mg/day)	AUF	Body Weight (1/kg)	Dose (mg/kg/day)	LOAEL (mg/kg/day)	HQ based on LOAEL	NOAEL (mg/kg/day)	HQ based on NOAEL
4,4'-DDD	56	5	280	0.012	0.0011	3.34	0.69	47.6	109.6	4	27	1	110
4,4'-DDE	22	5	110	0.012	0.0011	1.31	0.69	47.6	43.1	4	11	1	43
4,4'-DDT	110	5	550	0.012	0.0011	6.56	0.69	47.6	215.3	4	54	1	215
Total DDT	188	5	940	0.012	0.0011	11.20	0.69	47.6	368.0	4	92	1	368
Total Chlordane	32	4	128	0.012	0.0011	1.53	0.69	47.6	50.3	1.88	27	0.188	268

Chemical	Mean Soil Conc. (mg/kg)	BAF	Mean Conc in soil inv. (mg/kg)	Food Ingestion Rate (kg/day)	Soil Ingestion Rate (kg/day)	Intake from food and sed. (mg/day)	AUF	Body Weight (1/kg)	Dose (mg/kg/day)	LOAEL (mg/kg/day)	HQ based on LOAEL	NOAEL (mg/kg/day)	HQ based on NOAEL
4,4'-DDD	7.54	5	37.7	0.012	0.0011	0.45	0.69	47.6	14.8	4	3.7	1	15
4,4'-DDE	3.77	5	18.85	0.012	0.0011	0.22	0.69	47.6	7.4	4	1.8	1	7.4
4,4'-DDT	15.8	5	79	0.012	0.0011	0.94	0.69	47.6	30.9	4	7.7	1	31
Total DDT	27.1	5	135.5	0.012	0.0011	1.62	0.69	47.6	53.0	4	13	1	53
Total Chlordane	4.2	4	16.8	0.012	0.0011	0.20	0.69	47.6	6.6	1.88	3.5	0.188	35

Based on 1 ppm cleanup level

Chemical	Max Soil Conc. (mg/kg)	BAF	Conc in soil inv. (mg/kg)	Food Ingestion Rate (kg/day)	Soil Ingestion Rate (kg/day)	Intake from food and sed. (mg/day)	AUF	Body Weight (1/kg)	Dose (mg/kg/day)	LOAEL (mg/kg/day)	HQ based on LOAEL	NOAEL (mg/kg/day)	HQ based on NOAEL
4,4'-DDD	0.30	5	1.5	0.012	0.0011	0.02	0.69	47.6	0.6	4	0.1	1	0.6
4,4'-DDE	0.3	5	1.5	0.012	0.0011	0.02	0.69	47.6	0.6	4	0.15	1	0.6
4,4'-DDT	0.3	5	1.5	0.012	0.0011	0.02	0.69	47.6	0.6	4	0.1	1	0.6
Total DDT	1	5	5	0.012	0.0011	0.06	0.69	47.6	2.0	4	0.5	1	2.0
Total Chlordane	1	4	4	0.012	0.0011	0.05	0.69	47.6	1.6	1.88	0.8	0.188	8.4
Tot PCB as ref.	1	3	3	0.012	0.0011	0.04	0.69	47.6	1.2	0.13	9.1	0.1	11.9

Based on 2 ppm cleanup level

Chemical	Max Soil Conc. (mg/kg)	BAF	Conc in soil inv. (mg/kg)	Food Ingestion Rate (kg/day)	Soil Ingestion Rate (kg/day)	Intake from food and sed. (mg/day)	AUF	Body Weight (1/kg)	Dose (mg/kg/day)	LOAEL (mg/kg/day)	HQ based on LOAEL	NOAEL (mg/kg/day)	HQ based on NOAEL
4,4'-DDD	0.60	5	3	0.012	0.0011	0.04	0.69	47.6	1.2	4	0.3	1	1.2
4,4'-DDE	0.6	5	3	0.012	0.0011	0.04	0.69	47.6	1.2	4	0.3	1	1.2
4,4'-DDT	0.6	5	3	0.012	0.0011	0.04	0.69	47.6	1.2	4	0.3	1	1.2
Total DDT	2	5	10	0.012	0.0011	0.12	0.69	47.6	3.9	4	1.0	1	3.9
Total Chlordane	2	4	8	0.012	0.0011	0.10	0.69	47.6	3.1	1.88	1.7	0.188	17

Based on 5 ppm cleanup level

Chemical	Max Soil Conc. (mg/kg)	BAF	Conc in soil inv. (mg/kg)	Food Ingestion Rate (kg/day)	Soil Ingestion Rate (kg/day)	Intake from food and sed. (mg/day)	AUF	Body Weight (1/kg)	Dose (mg/kg/day)	LOAEL (mg/kg/day)	HQ based on LOAEL	NOAEL (mg/kg/day)	HQ based on NOAEL
4,4'-DDD	1.60	5	8	0.012	0.0011	0.10	0.69	47.6	3.1	1.25	2.5	1	3.1
4,4'-DDE	1.6	5	8	0.012	0.0011	0.10	0.69	47.6	3.1	1.25	2.5	1	3.1
4,4'-DDT	1.6	5	8	0.012	0.0011	0.10	0.69	47.6	3.1	1.25	2.5	1	3.1
Total DDT	5	5	25	0.012	0.0011	0.30	0.69	47.6	9.8	1.25	7.8	1	10
Total Chlordane	5	4	20	0.012	0.0011	0.24	0.69	47.6	7.9	0.19	41	0.188	42

Table 5. Food chain model for the robin

Chemical	Maximum Soil Conc. (mg/kg)	BAF	Max Conc in soil inv. (mg/kg)	Food Ingestion Rate (kg/day)	Soil Ingestion Rate (kg/day)	Intake from food and sed. (mg/day)	AUF	Body Weight (1/kg)	Dose (mg/kg/day)	LOAEL (mg/kg/day)	HQ based on LOAEL	NOAEL (mg/kg/day)	HQ based on NOAEL
4,4'-DDD	56	5	280	0.127	0.0132	36.30	0.015	9.48	5.2	1.25	4.1	0.125	41
4,4'-DDE	22	5	110	0.127	0.0132	14.26	0.015	9.48	2.0	1.25	1.6	0.125	16
4,4'-DDT	110	5	550	0.127	0.0132	71.30	0.015	9.48	10.1	1.25	8	0.125	81
Total DDT	188	5	940	0.127	0.0132	121.86	0.015	9.48	17.3	1.25	14	0.125	139
Total Chlordane	32	4	128	0.127	0.0132	16.68	0.015	9.48	2.4	0.19	12	0.019	125

Chemical	Mean Soil Conc. (mg/kg)	BAF	Mean Conc in soil inv. (mg/kg)	Food Ingestion Rate (kg/day)	Soil Ingestion Rate (kg/day)	Intake from food and sed. (mg/day)	AUF	Body Weight (1/kg)	Dose (mg/kg/day)	LOAEL (mg/kg/day)	HQ based on LOAEL	NOAEL (mg/kg/day)	HQ based on NOAEL
4,4'-DDD	7.54	5	37.7	0.127	0.0132	4.89	0.015	9.48	0.7	1.25	0.6	0.125	5.6
4,4'-DDE	3.77	5	18.85	0.127	0.0132	2.44	0.015	9.48	0.3	1.25	0.28	0.125	2.8
4,4'-DDT	15.8	5	79	0.127	0.0132	10.24	0.015	9.48	1.5	1.25	1.2	0.125	12
Total DDT	27.1	5	135.5	0.127	0.0132	17.57	0.015	9.48	2.5	1.25	2.0	0.125	20
Total Chlordane	4.2	4	16.8	0.127	0.0132	2.19	0.015	9.48	0.3	0.19	1.6	0.019	16

Based on 1 ppm cleanup level

Chemical	Max Soil Conc. (mg/kg)	BAF	Conc in soil inv. (mg/kg)	Ingestion Rate (kg/day)	Soil Ingestion Rate (kg/day)	Intake from food and sed. (mg/day)	AUF	Body Weight (1/kg)	Dose (mg/kg/day)	LOAEL (mg/kg/day)	HQ based on LOAEL	NOAEL (mg/kg/day)	HQ based on NOAEL
4,4'-DDD	0.30	5	1.5	0.127	0.0132	0.19	0.345	9.48	0.6	1.25	0.5	0.125	5.1
4,4'-DDE	0.3	5	1.5	0.127	0.0132	0.19	0.345	9.48	0.6	1.25	0.51	0.125	5.1
4,4'-DDT	0.3	5	1.5	0.127	0.0132	0.19	0.345	9.48	0.6	1.25	0.5	0.125	5.1
Total DDT	1	5	5	0.127	0.0132	0.65	0.345	9.48	2.1	1.25	1.7	0.125	17
Total Chlordane	1	4	4	0.127	0.0132	0.52	0.345	9.48	1.7	0.19	9.0	0.019	90
Tot PCB as ref	1	3	3	0.127	0.0132	0.39	0.345	9.48	1.3	9	0.1	0.9	1.4

Based on 2 ppm cleanup level

Chemical	Max Soil Conc. (mg/kg)	BAF	Conc in soil inv. (mg/kg)	Ingestion Rate (kg/day)	Soil Ingestion Rate (kg/day)	Intake from food and sed. (mg/day)	AUF	Body Weight (1/kg)	Dose (mg/kg/day)	LOAEL (mg/kg/day)	HQ based on LOAEL	NOAEL (mg/kg/day)	HQ based on NOAEL
4,4'-DDD	0.60	5	3	0.127	0.0132	0.39	0.345	9.48	1.3	1.25	1.0	0.125	10
4,4'-DDE	0.6	5	3	0.127	0.0132	0.39	0.345	9.48	1.3	1.25	1.0	0.125	10
4,4'-DDT	0.6	5	3	0.127	0.0132	0.39	0.345	9.48	1.3	1.25	1.0	0.125	10
Total DDT	2	5	10	0.127	0.0132	1.30	0.345	9.48	4.2	1.25	3.4	0.125	34
Total Chlordane	2	4	8	0.127	0.0132	1.04	0.345	9.48	3.4	0.19	18	0.019	179

Based on 5 ppm cleanup level

Chemical	Max Soil Conc. (mg/kg)	BAF	Conc in soil inv. (mg/kg)	Ingestion Rate (kg/day)	Soil Ingestion Rate (kg/day)	Intake from food and sed. (mg/day)	AUF	Body Weight (1/kg)	Dose (mg/kg/day)	LOAEL (mg/kg/day)	HQ based on LOAEL	NOAEL (mg/kg/day)	HQ based on NOAEL
4,4'-DDD	1.60	5	8	0.127	0.0132	1.04	0.345	9.48	3.4	1.25	2.7	0.125	27
4,4'-DDE	1.6	5	8	0.127	0.0132	1.04	0.345	9.48	3.4	1.25	2.7	0.125	27
4,4'-DDT	1.6	5	8	0.127	0.0132	1.04	0.345	9.48	3.4	1.25	2.7	0.125	27
Total DDT	5	5	25	0.127	0.0132	3.24	0.345	9.48	10.6	1.25	8	0.125	85
Total Chlordane	5	4	20	0.127	0.0132	2.61	0.345	9.48	8.5	0.19	45	0.019	449

Table 6. Food chain model for American woodcock.

Chemical	Maximum Soil Conc. (mg/kg)	BAF	Max Conc in soil inv. (mg/kg)	Food Ingestion Rate (kg/day)	Soil Ingestion Rate (kg/day)	Intake from food and sed. (mg/day)	AUF	Body Weight (1/kg)	Dose (mg/kg/day)	LOAEL (mg/kg/day)	HQ based on LOAEL	NOAEL (mg/kg/day)	HQ based on NOAEL
4,4'-DDD	56	5	280	0.083	0.0075	23.66	0.015	6.06	2.2	1.25	1.7	0.125	17
4,4'-DDE	22	5	110	0.083	0.0075	9.30	0.015	6.06	0.8	1.25	0.7	0.125	7
4,4'-DDT	110	5	550	0.083	0.0075	46.48	0.015	6.06	4.2	1.25	3	0.125	34
Total DDT	188	5	940	0.083	0.0075	79.43	0.015	6.06	7.2	1.25	6	0.125	58
Total Chlordane	32	4	128	0.083	0.0075	10.86	0.015	6.06	1.0	0.19	5	0.019	52

Chemical	Mean Soil Conc. (mg/kg)	BAF	Mean Conc in soil inv. (mg/kg)	Food Ingestion Rate (kg/day)	Soil Ingestion Rate (kg/day)	Intake from food and sed. (mg/day)	AUF	Body Weight (1/kg)	Dose (mg/kg/day)	LOAEL (mg/kg/day)	HQ based on LOAEL	NOAEL (mg/kg/day)	HQ based on NOAEL
4,4'-DDD	7.54	5	37.7	0.083	0.0075	3.19	0.015	6.06	0.3	1.25	0.2	0.125	2
4,4'-DDE	3.77	5	18.85	0.083	0.0075	1.59	0.015	6.06	0.1	1.25	0.12	0.125	1.2
4,4'-DDT	15.8	5	79	0.083	0.0075	6.68	0.015	6.06	0.6	1.25	0.5	0.125	5
Total DDT	27.1	5	135.5	0.083	0.0075	11.45	0.015	6.06	1.0	1.25	0.8	0.125	8
Total Chlordane	4.2	4	16.8	0.083	0.0075	1.43	0.015	6.06	0.1	0.19	0.7	0.019	7

Based on 1 ppm cleanup level

Chemical	Max Soil Conc. (mg/kg)	BAF	Conc in soil inv. (mg/kg)	Ingestion Rate (kg/day)	Soil Ingestion Rate (kg/day)	Intake from food and sed. (mg/day)	AUF	Body Weight (1/kg)	Dose (mg/kg/day)	LOAEL (mg/kg/day)	HQ based on LOAEL	NOAEL (mg/kg/day)	HQ based on NOAEL
4,4'-DDD	0.30	5	1.5	0.083	0.0075	0.13	0.015	6.06	0.0	1.25	0.01	0.125	0
4,4'-DDE	0.3	5	1.5	0.083	0.0075	0.13	0.015	6.06	0.0	1.25	0.01	0.125	0.1
4,4'-DDT	0.3	5	1.5	0.083	0.0075	0.13	0.015	6.06	0.0	1.25	0.01	0.125	0
Total DDT	1	5	5	0.083	0.0075	0.42	0.015	6.06	0.0	1.25	0.03	0.125	0
Total Chlordane	1	4	4	0.083	0.0075	0.34	0.015	6.06	0.0	0.19	0.2	0.019	2
Tot PCB as ref.	1	3	3	0.083	0.0075	0.26	0.015	6.06	0.0	9	0.003	0.9	0

Based on 2 ppm cleanup level

Chemical	Max Soil Conc. (mg/kg)	BAF	Conc in soil inv. (mg/kg)	Ingestion Rate (kg/day)	Soil Ingestion Rate (kg/day)	Intake from food and sed. (mg/day)	AUF	Body Weight (1/kg)	Dose (mg/kg/day)	LOAEL (mg/kg/day)	HQ based on LOAEL	NOAEL (mg/kg/day)	HQ based on NOAEL
4,4'-DDD	0.60	5	3	0.083	0.0075	0.25	0.015	6.06	0.0	1.25	0.0	0.125	0
4,4'-DDE	0.6	5	3	0.083	0.0075	0.25	0.015	6.06	0.0	1.25	0.02	0.125	0.2
4,4'-DDT	0.6	5	3	0.083	0.0075	0.25	0.015	6.06	0.0	1.25	0.0	0.125	0
Total DDT	2	5	10	0.083	0.0075	0.85	0.015	6.06	0.1	1.25	0.1	0.125	1
Total Chlordane	2	4	8	0.083	0.0075	0.68	0.015	6.06	0.1	0.19	0.3	0.019	3

Based on 5 ppm cleanup level

Chemical	Max Soil Conc. (mg/kg)	BAF	Conc in soil inv. (mg/kg)	Ingestion Rate (kg/day)	Soil Ingestion Rate (kg/day)	Intake from food and sed. (mg/day)	AUF	Body Weight (1/kg)	Dose (mg/kg/day)	LOAEL (mg/kg/day)	HQ based on LOAEL	NOAEL (mg/kg/day)	HQ based on NOAEL
4,4'-DDD	1.60	5	8	0.083	0.0075	0.68	0.015	6.06	0.1	1.25	0.0	0.125	0
4,4'-DDE	1.6	5	8	0.083	0.0075	0.68	0.015	6.06	0.1	1.25	0.05	0.125	0.5
4,4'-DDT	1.6	5	8	0.083	0.0075	0.68	0.015	6.06	0.1	1.25	0.0	0.125	0
Total DDT	5	5	25	0.083	0.0075	2.11	0.015	6.06	0.2	1.25	0.2	0.125	2
Total Chlordane	5	4	20	0.083	0.0075	1.70	0.015	6.06	0.2	0.19	0.8	0.019	8

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